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Wu et al.

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[54] POLY (ARYLAMINES) AND FILMS THEREOF

[75] Inventors: Weishi Wu; Edmund P. Woo; William R. Shiang, all of Midland, Mich.

[73] Assignee: The Dow Chemical Company, Midland, Mich.

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[56] References Cited

U.S. PATENT DOCUMENTS

4,356,429 10/1982 Tang .
 4,539,507 9/1985 VanSlyke et al. .
 4,885,211 12/1989 Tang et al. .
 5,047,687 9/1991 VanSlyke .
 5,059,862 10/1991 VanSlyke et al. .
 5,061,561 10/1991 Katayama .
 5,256,945 10/1993 Imai et al. .
 5,352,554 10/1994 Mishima et al. .
 5,352,834 10/1994 Morishita et al. .

FOREIGN PATENT DOCUMENTS

0 372 979 5/1990 European Pat. Off. .
 0 443 861 A2 8/1991 European Pat. Off. .
 0 517 542 A1 12/1992 European Pat. Off. .
 0 637 899 A1 2/1995 European Pat. Off. .
 0 710 893 A1 5/1996 European Pat. Off. .
 0 721 935 A1 7/1996 European Pat. Off. .
 95/09147 4/1995 WIPO .
 97/09394 3/1997 WIPO .

OTHER PUBLICATIONS

Colon, et al., *Journal of Polymer Science, Part A, Polymer Chemistry*, vol. 28, pp. 367-383 (1990).
 Pai D. M. et al., *Journal Phys. Chem.*, vol. 88, pp. 4714-4717 (1984).
 Tang, C. W. et al., *Appl. Phys. Lett.*, vol. 51, pp. 91-915 (1987).
 Adachi, Chihaya et al., *Appl. Phys. Lett.*, vol. 56, pp. 799-801 (1990).
 Kido, Junji et al., *Appl. Phys. Lett.*, vol. 61, pp. 761-763 (1992).
 Gautlich, Sylvie, et al., *Synthesis*, pp. 383-385 (1987).
 Guram, Anil S. et al., *Angewandte Chemie Int'l. Ed. in English*, vol. 34, pp. 1348-1350 (1995).
 Iyoda et al., *Bulletin of the Chemical Society of Japan*, vol. 63, pp. 80-87 (1990).
 Miyama et al., *Synthetic Communication*, vol. 11, pp. 513-519 (1981).
 Wallow et al., *American Chemical Society Polymer Preprint*, vol. 34(1), pp. 1009-1010 (1993).

Yamamoto, Takakazu, *Progress in Polymer Science*, vol. 17, pp. 115-1205 (1992). Abstract of JP 05311163-A.

Adachi, Chihaya et al., "Confinement of Charge Carriers and Molecular Excitons with in 5-nm-thick Emitter Layer in Organic Electroluminescent Devices with a Double Heterostructure", *APPL. PHYS. LETT.*, vol. 57, No. 6 (Aug. 6, 1990).

Baker, T. Nelson, III et al., "Electrophilic Substitution Reactions of Triphenylamine", *Journal of Organic Chemistry*, vol. 30, pp. 3714-3718 (Nov. 1965).

Chemical Abstract, 93-365193/46 (1993).

Ishikawa, Masazumi et al., "Synthesis and Properties of Electrically Conducting Polytriphenylamines", *SYNTHETIC METALS*, vol. 40, pp. 231-238 (1991).

Ishikawa Wataru et al., "Novel Amorphous Molecular Materials: The Starburst Molecule 1,3,5-Tris [N-(4-diphenylaminophenyl)-phenylamino]benzene", *Advanced Materials*, vol. 5, No. 7/8, pp. 559-561 (1993).

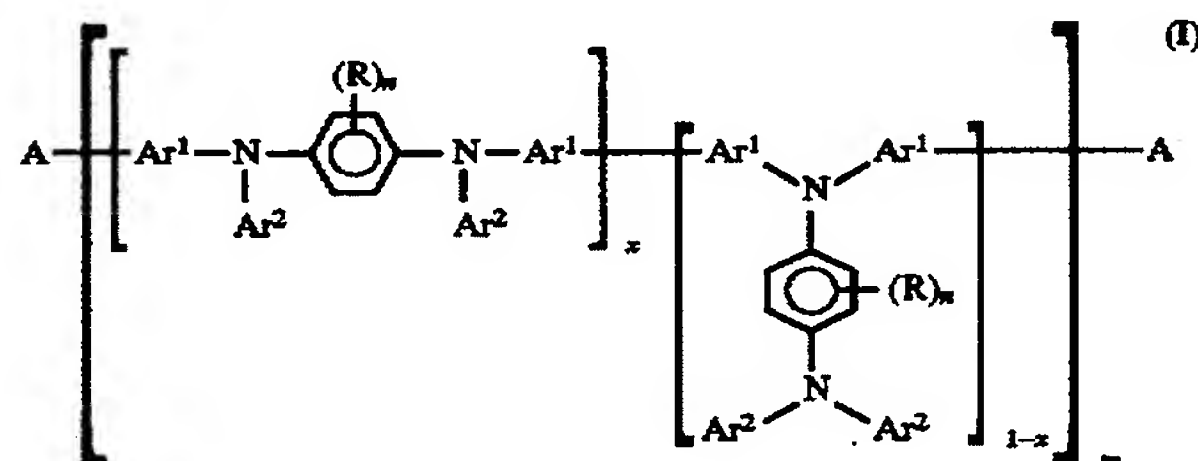
Kuwabara, Yoshiyuki et al., "Thermally Stable Multilayered Organic Electroluminescent Devices Using Novel Starburst Molecules, 4,4', 4"-Tri(N-carbazolyl)triphenylamine (TCTA) and 4,4', 4"-Tris(3-methylphenylphenylamino)triphenylamine (m-MTDATA), as Hole-Transport Materials", *Advance Materials*, vol. 6, No. 9, pp. 677-679 (1994).
 Derwent 97-359265/199733 (JP 915137 A).

Primary Examiner—Duc Truong

Attorney, Agent, or Firm—Ann K. Galbraith; Jill V. Blasy

[57] ABSTRACT

A poly(arylamine) composition comprising one or more compounds of Formula (I):



wherein:

R is independently in each occurrence a C₁₋₂₄ hydrocarbyl, C₁₋₂₄ hydrocarboxy, C₁₋₂₄ hydrocarbylthiooxy, or C₁₋₂₄ hydrocarbylcarboxyl;

Ar¹ and Ar² are independently in each occurrence a C₆₋₁₈ aryl moiety optionally substituted with a C₁₋₁₂ hydrocarbyl, C₁₋₁₂ hydrocarbyloxy, C₁₋₁₂ hydrocarbylthiooxy, or C₁₋₁₂ hydrocarbylcarboxyl;

A is independently in each occurrence hydrogen or a halogen;

x is independently in each occurrence a positive number from 0 to 1;

n is independently in each occurrence a whole number of from 0 to 4; and

m is a number of from about 5 to about 1000.

17 Claims, No Drawings